REMARKS

Applicants appreciate the Examiner's thorough review of the present application indicated by the Office Action dated March 2, 2006 (hereinafter, "the Office Action). Claims 1-11, 13 and 16-21 stand rejected. Applicants respectfully submit that these claims are patentable for at least the reasons discussed below.

I. Claims Objections

Claims 7, 11 and 13 stand objected to on the basis of the informalities stated in the Office Action on pages 2 through 3. Applicants have amended these claims herein in view of the comments provided in the Office Action. Accordingly, Applicants respectfully request that the objection to Claims 7, 11 and 13 be withdrawn for at least this reason.

II. Claims Rejections Under 35 U.S.C. §102(a) in View of Ekerdt et al.

Claims 1, 3-6 and 10 stand rejected under 35 U.S.C. §102(a) as being anticipated by Ekerdt et al. "Design, growth and Properties of Boron Carbonitride Insulating Diffusion Barriers for Nanosized Electronic Devices" (hereinafter, "Ekerdt et al."). *See* Office Action, page, 4. The Office Action further indicates that "[i]f the reference is not published before 04/17/2003 . . . Applicant just has to mention briefly in the next communication." Office Action, page 4.

Applicants respectfully submit that Ekerdt et al. is an abstract for a National Science Foundation grant. As shown in the supporting documentation attached herewith, the abstract was forwarded to the NSF contract officer in 2006. The grant was awarded effective after May 13, 2006. Accordingly, Applicants respectfully request that the rejection under 35 U.S.C. §102(a) in view of Ekerdt et al. be withdrawn for at least this reason.

III. Claim Rejections Under 35 U.S.C. §102(b) in View of Levy et al.

Claims 1 and 4-6 stand rejected under 35 U.S.C. §102(b) as being anticipated by Levy et al. "Evaluation of LPCVD Boron Nitride as a Low Dielectric Constant Material" *Mat. Res. Soc. Symp.* **427** 469-478 (1996) (hereinafter, "Levy et al."). *See* Office Action, page 5. More specifically, the Office Action indicates that Levy et al.

discloses "a method of forming a boron carbo-nitride layer" citing the abstract in support thereof. Office Action, page 5. Yet, the Abstract merely states the following:

> A hydrogen-free boron-containing membrane in tension exhibits advantageous properties for use as a mask in X-ray lithography.

Abstract, Levy et al.

The Summary of the Invention states the following:

> Applicant has discovered that a stable high-quality mask membrane suitable for fabricating devices by X-ray lithography can be made with a material that comprises hydrogen-free **boron nitride**. An advantageous such material has a boron-to-nitrogen atomic ratio of 1-to-1 and is designated herein as **BN**.

Levy et al., column 2, lines 15-20 (emphasis added). As evidenced by the passages recited above, U.S. Patent No. 4,868,093 to Levy et al. entitled "Device Fabrication by X-Ray Lithography Utilizing Stable Boron Nitride Mask" is directed to the use of a **boron nitride** mask. Applicants respectfully submit that Levy et al. fails to teach or suggest a method of forming a **boron carbo-nitride** layer as recited in Claim 1.

Accordingly, Applicants respectfully request that the rejection of Claims 1 and 4-6 under 35 U.S.C. §102(b) in view of Levy et al. be withdrawn for at least these reasons.

IV. Claim Rejections Under 35 U.S.C. §102(a) in View of Kosinova et al.

Claims 1-2 and 4-6 stand rejected under 35 U.S.C. §102(a) as being anticipated by Kosinova et al. "Chemical Composition of Boron Carbonitride Films Grown by Plasma-Enhanced Chemical Vapor Deposition from Trimethylamineborane" *Inorganic Materials* **39(4)** 366-373 (2003) (hereinafter, "Kosinova et al.). *See* Office Action, page 6. In particular, the Office Action asserts that Kosinova et al. discloses a method of forming a boron carbo-nitride layer by chemical vapor deposition that is a "thermal chemical vapor deposition." Office Action, page 7. Applicants respectfully disagree.

The Office Action states that in Kosinova et al., "chemical vapor deposition is a thermal chemical vapor deposition (the substrate is maintained at a temperature, and the process is maintained at a certain temperature, disclosed throughout the reference) qualifying the chemical vapor deposition process as a thermal chemical vapor

deposition." Office Action, page 7 (citations omitted). However, Kosinova et al. is directed to the use of **plasma-enhanced chemical vapor deposition (PECVD)** and not **thermal chemical vapor deposition (TCVD)** as recited in amended Claim 1. Applicants respectfully submit that PECVD and TCVD are distinct processes. In fact, Applicants' specification recites the following regarding these processes:

> One method of providing the insulating barrier layer is through plasma enhanced chemical vapor deposition (PECVD). Thermal chemical vapor deposition (TCVD) is a process in which a flow of gaseous reactants over a heated semiconductor substrate chemically react to deposit a solid layer on the heated substrate. PECVD is a process which introduces a plasma to activate the gaseous reactants. In each case, the flow of the reactants can be in parallel or in series, whereby a series flow of reactants is sometimes referred to as atomic layer deposition.
>
> One current manufacturing technology for producing an insulating barrier layer generally is transitioning from plasma enhanced chemical vapor deposited (PECVD) SiNx to PECVD SiCxNy and SiCx because these materials generally have a lower dielectric constant. Recent studies have reported PECVD SiCxNy films with dielectric constants of approximately 5 and PECVD SiCx films with a dielectric constant less than 5, resulting in an approximately 25% lower a dielectric constant compared to PECVD SiNx. *See*, Martin et al., 2002 IEEE International Interconnect Technology Conference, Burlingame, CA, June 3-5, 2002, 42; and Fayolle et al., 2002 IEEE International Interconnect Technology Conference, Burlingame, CA, June 3-5, 2002, 39. However, PECVD film deposition can cause damage to the bulk insulating material, commonly referred to as the intermetal/intrametal dielectric. Also, current Si-based PECVD films may not meet future performance requirements, such as adhesion to other interconnect films, electromigration performance with copper, barrier properties, or low current leakage.

Present Application, page 2. Thus, the processes are not interchangeable. More significantly, however, TCVD is not taught or suggested in Kosinova et al. Instead, Kosinova et al. is reflective of the body literature directed to the conventional method of using PECVD to form the boron-containing films described therein.

Accordingly, Applicants respectfully submit that Kosinova et al. does not anticipate amended Claim 1 or Claims 4-6, and Applicants respectfully request that these claim rejections be withdrawn for at least these reasons.

V. Claim Rejections Under 35 U.S.C. §103(a) in View of Kosinova et al.

Claims 3, 7-11, 13 and 16-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kosinova et al. *See* Office Action, page 7. For at least similar reasons provided above, namely, Kosinova et al. fails to teach or suggest a method of forming a boron carbo-nitride layer on a substrate by **thermal** chemical vapor deposition, Applicants respectfully request that the rejection of Claims 3, 7-11, 13 and 16-21 be withdrawn.

Conclusion

Applicants respectfully submit that, for at least the reasons discussed above, the amendments and remarks herein address the outstanding objections to and rejections of the claims. Accordingly, Applicants respectfully request allowance of all the pending claims and passing this application to issue.

The Examiner is encouraged to direct any questions regarding the foregoing to the undersigned, who may be reached at (919) 854-1400.

Respectfully submitted,

Shawna Cannon Lemon
Registration No. 53,888
Attorney for Applicants

Customer Number 20792
Myers Bigel Sibley & Sajovec, P.A.
P.O. Box 37428
Raleigh, NC 27627
919-854-1400
919-854-1401 (Fax)

CERTIFICATION OF ELECTRONIC TRANSMISSION UNDER 37 CFR § 1.8

I hereby certify that this correspondence is being transmitted electronically to the U.S. Patent and Trademark Office on May 31, 2006.

Sarah B. Abraham
Date of Signature: May 31, 2006

Serial No. 10/826,564
Attachment to Amendment
dated May 31, 2006

Lemon, Shawna

From: John G. Ekerdt [ekerdt@che.utexas.edu]
Sent: **REDACTED**
To: Lemon, Shawna
Subject: Supporting Documents for SRC Ref P0372

REDACTED

X-IronPort-MID: 1821972931
X-SBRS: 1.9
X-BrightmailFiltered: true
X-Brightmail-Tracker: AAAAAQAAA+k=
X-IronPort-AV: i="4.03,125,1141624800";
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X-SBRS: None
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Date: Fri, 24 Mar 2006 08:47:20 -0500
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X-MS-TNEF-Correlator:
Thread-Topic: Your MWN Proposal # 0603004
Thread-Index: AcZPSXZ30uJ51RYGShebr8rYF1yIHg==
From: "Akkara, Joseph" <jakkara@nsf.gov>
To: <ekerdt@che.utexas.edu>
Cc: "Hess, LaVerne D." <lhess@nsf.gov>, "Huber, Carmen" <chuber@nsf.gov>
X-OriginalArrivalTime: 24 Mar 2006 13:47:21.0029 (UTC) FILETIME=[7924A750:01C64F49]
X-Chemical_Engineering-MailScanner-Information: Please send an email to assist@che.utexas.edu for more information
X-Chemical_Engineering-MailScanner: Found to be clean
X-MailScanner-From: jakkara@nsf.gov

Dear Prof. Ekerdt:

Your Materials World Network proposal, DMR-0603004, has been reviewed. I am pleased to inform you that the program plans to recommend the proposal for funding. Based on the reviews and availability of funds, funding will be recommended at $128,000 / year for 3 years for a total amount of $384,000. Please submit a revised budget in Fastlane as soon as possible but no later than March 31. Since the recommended award budget is reduced from the request by more than 10%, you also need to submit a revised project scope/impact statement using the Revised Budget Module of Fastlane.

The Division of Materials Research (DMR) would like to see students and junior researchers participate in international research experiences. I strongly encourage you to do as planned in the proposal and to allocate the necessary resources.

Please also send me by email by March 31 an abstract for the award. Examples of MWN award abstracts can be found at http://www.nsf.gov/mps/dmr/awards/mwn.jsp.

REDACTED

Your award will be co-funded and managed by the Electronic Materials program in DMR. I am copying Dr. LaVerne Hess, Program Director, Electronic Materials Program.

Feel free to contact me, should you have any questions.

With best regards, and congratulations!

Joseph A. Akkara
Program Director
Division of Materials Research
National Science Foundation
Arlington, VA 22230

703-292-4946 (Voice)
703-292-9036 (Fax)

Serial No. 10/826,564
Attachment to Amendment
dated May 31, 2006

John G. Ekerdt
Dick Rothwell Endowed Chair in Chemical Engineering
CPE 4.468
(512) 471-4689
(512) 471-7060 (fax)
ekerdt@che.utexas.edu

REDACTED

Lemon, Shawna

From: John G. Ekerdt [ekerdt@che.utexas.edu]
Sent: **REDACTED**
To: Lemon, Shawna
Subject: Supporting Documents for SRC Ref P0372 File No 5347_219

REDACTED

>Date: Mon, 27 Mar 2006 16:40:53 -0600
>To: jakkara@nsf.gov
>From: "John G. Ekerdt" <ekerdt@che.utexas.edu>
>Subject: Abstract and Revised Budget for 0603004/Ekerdt
>Cc: lhess@nsf.gov, chuber@nsf.gov
>
>Joseph, Vern and Carmen,
>
>The revised budget for the Materials World Network proposal, DMR-0603004
>has been sent forward to NSF by the UT Sponsored Projects Office. I am
>copying you on the fastlane correspondence that follows. I have enclosed
>two versions of the Abstract, in Word and pdf formats. This way you can
>modify the abstract if you feel it can be improved. If this is too long,
>let me know and I will make the changes.
>
>I trust this is everything you need and I look forward to working with all
>associated with this program.
>
>John
>
>
>
>>X-IronPort-MID: 1824914348
>>X-SBRS: 5.7
>>X-BrightmailFiltered: true
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>> d="scan'208"; a="1824914348:sNHT18718384"
>>Date: Mon, 27 Mar 2006 15:52:37 -0500 (EST)
>>From: fastlane@fastlane.nsf.gov
>>To: ekerdt@che.utexas.edu
>>Subject: fastlane: Revised Budget for 0603004/Ekerdt
>>X-Chemical_Engineering-MailScanner-Information: Please send an email to
>>assist@che.utexas.edu for more information
>>X-Chemical_Engineering-MailScanner: Found to be clean
>>X-MailScanner-From: fastlane@fastlane.nsf.gov

>>
>>Revised Proposal Budget was submitted via FastLane on Mar 27 2006 3:52PM
>>for Proposal 0603004
>>PI First Name: John
>>PI Last Name : Ekerdt
>>PI E-Mail Address: ekerdt@che.utexas.edu
>>Institution Name: University of Texas at
>>Austin
>>Division: DMR
>>Program Element Code: 7222
>>
>>Mon Mar 27 15:52:37 EST 2006
>>
>>This e-mail was sent from an address that cannot accept incoming e-mail
>>therefore please DO NOT REPLY TO THIS MESSAGE.
>

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>John G. Ekerdt
>Dick Rothwell Endowed Chair in Chemical Engineering
>CPE 4.468
>(512) 471-4689
>(512) 471-7060 (fax)
>ekerdt@che.utexas.edu
>==========

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John G. Ekerdt
Dick Rothwell Endowed Chair in Chemical Engineering
CPE 4.468
(512) 471-4689
(512) 471-7060 (fax)
ekerdt@che.utexas.edu
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